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Effect of Integrated Nutrient Management on Vegetative Growth and Floral Attributes in Gladiolus

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ABSTRACT

The present experiment was conducted to study the effect of nutrient management on vegetative growth and floral attributes in gladiolus cv. saffron at college premises, Horticultural Research cum Instructional farm, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur during the year 2021-22. The experiment was laid out in Randomized Block Design (RBD) with three replications having ten treatment combinations. The result showed that T_5 [75% RDF + FYM@12.5 t/ha + 0.3% foliar spray of WSF 13:0:45 (Once)] recorded earliest 50% sprouting of corms (12.67d), more number of shoots per plant (1.40), maximum plant height 34.20 cm and 69.07 cm at 25 and 50 DAP respectively) and more number of leaves (2.93 and 5.53 at 25 and 50 DAP respectively). Similarly in flowering attributes, earliest in spike emergence (69.20d), first floret open (75.40d), more number of spike per plant (1.40), Maximum spike length (78.50 cm) and rachis length (46.23 cm) was observed in treatment T_5 (75% RDF + FYM@12.5 t/ha + 0.3% foliar spray of WSF 13:0:45).

Key Words: RDF, FYM, Vermicompost, Azotobacter, PSB

INTRODUCTION

Gladiolus (*Gladiolus grandiflorus* L.) is one of the most popular bulbous cut flowers grown in India and other countries. Gladiolus is known as Queen of bulbous ornamental Plant. It is native of South Africa and belongs to family Iridaceae. Gladiolus is highly nutrient loving crop. It is generally propagated by corms and cormels. Gladiolus spikes are mainly used for interior decoration and bouquet manufacturing. Gladiolus is also utilized in herbaceous borders, bedding purpose and for flower arrangements etc. In some regions of Africa, gladiolus is used for medicinal purpose for treatment of diarrhea, constipation and colds. It is also used to cure hypochondriacs and boosts mood and energy level.

Integrated Nutrient Management (INM) is the judicious application of chemical fertilizers along with organic fertilizers to get higher net returns without affecting the physical conditions of soil. Application of organic manures, bio-fertilizers and judicious application of fertilizers help to get more yield and good quality of flowers. Organic manures like Farmyard manure (FYM) and vermicompost play a major role in crop production. Bio-fertilizers like Azotobacter and PSB when applied to soil, seed and other planting materials can mobilize the availability of nutrients through biological activity such as biological nitrogen fixation from atmosphere. These are also help in the development of micro-flora and hasten certain microbial process to increase the availability of nutrients in a form which can be easily assimilated by the plants.

MATERIALS AND METHODS

The experiment was carried out during the year 2021-22 to study the effect of nutrient management on vegetative growth, floral attributes and corm production in gladiolus cv. saffron at college premises, Horticultural Research cum Instructional farm, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur. The experiment was laid

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out in Randomized Block Design (RBD) with ten treatments and three replications to analyse the effect of the treatments in vegetative growth, floral attributes and corm production in gladiolus. The field experiment comprised of ten treatments *i.e.* T_1: Control (100% RDF) (150:200:100 kg NPK/ha), T_2: 100% RDF + 0.3% foliar spray of WSF 13:0:45 (Twice), T_3: 75% RDF + FYM@12.5t/ha + 0.3% foliar spray of WSF 13:0:45 (Twice), T_4: 75% RDF + Vermicompost@2.5t/ha + 0.3% foliar spray of WSF 13:0:45 (Twice), T_5: 75% RDF + FYM@12.5 t/ha + 0.3% foliar spray of WSF 13:0:45 (Once), T_6: 75% RDF + Vermicompost@2.5t/ha + 0.3% foliar spray of WSF 13:0:45 (once), T_7: 60% RDF + FYM@12.5t/ha + 0.3% foliar spray of WSF 13:0:45 (Twice), T_8: 60% RDF + Vermicompost@2.5t/ha + 0.3% foliar spray of WSF 13:0:45 (Twice), T_9: 60% RDF + FYM@12.5 t/ha + 0.3% foliar spray of WSF 13:0:45 (Once), T_{10}: 60% RDF + Vermicompost@2.5t/ha + 0.3% foliar spray of WSF 13:0:45 (once).

RESULTS AND DISCUSSION

Growth Parameters

Days to sprouting of corm

For sprouting of 50 percent of corms, minimum number of days (12.67) was taken by treatment T_5 [(75% RDF + FYM@12.5 t/ha + 0.3% foliar spray of WSF 13:0:45 (Once)] which was significantly superior over T_1, T_2, T_7, T_8, T_9 and T_{10}. However, the result obtained in T_5 was statistically *at par* with the treatments T_6, T_3 and T_4. The maximum number of days (20.33) taken for sprouting of 50 per cent of corms was recorded in treatment T_1 (Control: 100% RDF). It might be due to the inoculation with bacterial mixtures like Azotobacter and PSB which provide more balanced nutrition to the plant and optimum absorption of bio-fertilizers by corm hasten the physiological process and also help in increasing the availability of nitrogen and phosphorus into the plant system and improve the sprouting phenomenon. The result was in accordance with the findings of Ali *et al* (2013) and Adhikari *et al* (2018).

Number of shoots per plant

The result of the number of shoots per plant indicates that application of different treatments was found non-significant with respect to number of shoots per plant. Maximum number of shoots per plant (1.40) was obtained in the treatment T_5, whereas minimum number of shoots per plant (1.13) was observed in T_1.

Plant height (cm)

Application of different treatments was found non-significant with respect to plant height at 25 DAP. Maximum plant height at 25 DAP (34.20 cm) and minimum plant height at 25 DAP (28.67 cm) were noticed in treatment T_5 and T_1 respectively. But in 50 DAP, the treatment was found significant difference among the treatments and maximum plant height (69.07 cm) was observed in treatment T_5. The result of maximum plant height at 50 DAP in the treatment T_5 was found superior over T_1, T_2, T_7, T_8, T_9 and T_{10} and the result obtained in T_5 were found statistically *at par* with the treatments T_6, T_3 and T_4. However, minimum plant height was observed in treatment T_1 (60.50 cm). Maximum plant height in treatment T_5 at 50 DAP may be due to the presence of readily available form of nitrogen by the application of *Azotobacter* inoculum. The increased availability of nutrient with increase in organic sources like FYM and vermicompost (T_5 and T_6) that may be resulted in the enhancement of vegetative growth and thus increase the plant height. This result was in accordance to the findings of Ali *et al* (2013) and Basant *et al* (2020) in gladiolus and tuberose respectively. Mandavi *et al* (2018) and Devi *et al* (2019) also found alike results in gladiolus.

Number of leaves per plant

Non-significant result was obtained by the application of different treatments at 25 DAP. Maximum number of leaves per plant (2.93) in

Table 1. Effect of Integrated Nutrient Management on Vegetative growth in Gladiolus cv. Saffron.

Treatment	Days to sprouting of corm	Number of shoots per plant	Plant height		Number of leaves per plant	
			25 DAP	50 DAP	25 DAP	50 DAP
T_1	20.33	1.13	28.67	60.50	2.13	4.40
T_2	18.67	1.20	29.83	63.27	2.33	4.67
T_3	14.67	1.33	32.60	68.07	2.73	5.33
T_4	15.33	1.33	32.63	67.17	2.67	5.33
T_5	12.67	1.40	34.20	69.07	2.93	5.53
T_6	13.33	1.33	33.63	68.63	2.87	5.47
T_7	17.67	1.13	30.40	64.33	2.60	4.87
T_8	17.33	1.13	30.40	64.07	2.40	4.87
T_9	16.00	1.20	31.83	65.20	2.67	4.27
T_{10}	16.67	1.20	30.77	65.07	2.67	4.20
SEm±	0.72	0.07	1.65	1.47	0.16	0.13
C.D(p=0.05)	2.16	NS	NS	4.40	NS	0.38

treatment T_5 [(75% RDF + FYM@12.5 t/ha + 0.3% foliar spray of WSF 13:0:45 (Once)] and minimum number of leaves per plant (2.13) in treatment T_1 (Control: 100% RDF) were observed at 25 DAP. At 50 DAP, significant difference was observed among the treatments. Maximum number of leaves (5.53) was noted in treatment T_5 which was superior over T_1, T_2, T_7, T_8, T_9 and T_{10} and was found close to the result of the treatments T_6, T_3 and T_4. Minimum number of leaves (4.40) was recorded in treatment T_1. More number of leaves in treatment T_5 is probably due to the availability of essential nutrient through chemical fertilizer and organic nutrient (FYM). The availability of nutrients especially nitrogen is also increased due to the application of foliar spray of water soluble Potassium nitrate fertilizer (13:0:45) that may be leads to the multiplication and enlargement of plant cell which might enhance the photosynthetic rate and ultimately helped in increasing number of leaves. This result has similarity with the findings of Rajhansa *et al* (2010), Kumar and Saravanan (2019) and Dhakad *et al* (2019) in gladiolus.

Flowering Attributes

Days to spike emergence

Days to spike emergence was found significantly differ among the treatments. Minimum number of days taken for spike initiation (69.20) was observed in treatment T_5 [(75% RDF + FYM@12.5 t/ha + 0.3% foliar spray of WSF 13:0:45 (Once)]. From the result, significant difference was observed in treatment T_1, T_2, T_7 and T_8, whereas it was observed statistically *at par* with the treatments T_6, T_3, T_4, T_9 and T_{10}, whereas maximum number of days taken for spike emergence (75.47) was observed in T_1 (Control: 100% RDF).

Days to first floret open

Earliest opening of first floret (75.40) was noticed in treatment T_5 [(75% RDF + FYM@12.5 t/ha + 0.3% foliar spray of WSF 13:0:45 (Once)]. In treatment T_1, T_2, T_7 and T_8 significant difference was observed, whereas treatment T_5 was found statistically *at par* with the treatments T_6, T_3, T_4, T_9 and T_{10}. However, maximum number of days taken for first floret open (82.73) was observed

Table 2. Effect of Integrated Nutrient Management on floral attributes in Gladiolus cv. Saffron.

Treatment	Days to spike emergence	Days to first floret open	Number of spike per plant	Length of spike (cm)	Length of rachis (cm)	Number of florets per spike
T_1	75.47	82.73	1.13	72.10	41.07	12.27
T_2	74.47	82.00	1.20	73.70	41.63	12.33
T_3	70.73	78.47	1.33	77.27	44.87	13.80
T_4	71.60	78.53	1.33	77.20	44.33	13.73
T_5	69.20	75.40	1.40	78.50	46.23	14.20
T_6	70.27	76.87	1.33	77.60	45.07	14.00
T_7	72.60	79.73	1.13	76.43	42.27	12.67
T_8	73.33	80.20	1.13	75.67	42.17	12.60
T_9	71.67	78.60	1.20	76.67	43.10	12.87
T_{10}	72.33	78.80	1.20	76.57	42.90	12.80
SEm±	1.06	1.20	0.07	0.50	0.72	0.18
C.D(p=0.05)	3.19	3.60	NS	1.50	2.16	0.54

[T1: Control (100% RDF) (150:200:100 kg NPK/ha), T2: 100% RDF + 0.3% foliar spray of WSF 13:0:45 (Twice), T3: 75% RDF + FYM@12.5t/ha + 0.3% foliar spray of WSF 13:0:45 (Twice), T4: 75% RDF + Vermicompost@2.5t/ha + 0.3% foliar spray of WSF 13:0:45 (Twice), T5: 75% RDF + FYM@12.5 t/ha + 0.3% foliar spray of WSF 13:0:45 (Once), T6: 75% RDF + Vermicompost@2.5t/ha + 0.3% foliar spray of WSF 13:0:45 (once), T7: 60% RDF + FYM@12.5t/ha + 0.3% foliar spray of WSF 13:0:45 (Twice), T8: 60% RDF + Vermicompost@2.5t/ha + 0.3% foliar spray of WSF 13:0:45 (Twice), T9: 60% RDF + FYM@12.5 t/ha + 0.3% foliar spray of WSF 13:0:45 (Once), T10: 60% RDF + Vermicompost@ 2.5t/ha + 0.3% foliar spray of WSF 13:0:45 (once)]

in T_1 (Control: 100% RDF). Earliness in spike emergence in the plant was possibly due to increased availability of nutrient with the application of RDF, organic manure along with foliar application of water soluble potassium nitrate (13:0:45) which probably stimulates the faster mobilization of photosynthates and help in early transformation of plant parts from vegetative to reproductive stage. Thus, it may stimulate early emergence of spike and ultimately lead to early opening of first floret. The results can be confirmed from the findings of Meena *et al* (2018) and Baruati *et al* (2018) in gladiolus. Similar observation was also recorded by Meena *et al* (2015) and Kumar and Saravanan (2019) and in tuberose and gladiolus respectively. Application of different treatment was found non-significant with respect to number of spike per plant. Maximum number of spike per plant (1.40) was obtained in the treatment T_5 while, minimum number of spike per plant (1.13) noticed in T_1.

Length of spike (cm)

Maximum spike length (78.50 cm) was observed in treatment T_5, which was found superior over treatments T_1, T_2, T_7, T_8, T_9 and T_{10}, whereas the result obtained in T_5 were found statistically *at par* with the treatments T_6, T_3 and T_4. Minimum spike length was observed with treatment T_1 (72.10 cm). The longest spike length in treatment T_5 might be due to the application of bio-fertilizer like *Azotobacter* and PSB in combination with inorganic fertilizers that might increase the availability of nitrogen and

other nutrient elements and enhance the level of macronutrients which have positive impact on floral characteristics and ultimately increased the spike length. The results were in confirmation with the findings of Ali *et al* (2013) and Meena *et al* (2018) in gladiolus. Similar results were also reported by Devi *et al* (2019) in gladiolus and Meena *et al* (2015) in tuberose.

Length of rachis (cm)

Longest rachis length (46.23 cm) was observed in treatment T_5. The result was found superior over treatment T_1, T_2, T_7, T_8, T_9 and T_{10}, whereas the result obtained in T_5 were found statistically *at par* with the treatments T_6, T_3 and T_4. Shortest length of rachis was observed in treatment T_1 (41.07 cm). Longest rachis length found in treatment T_5 possibly due to that application of bio-fertilizer like *Azotobacter* accumulate nitrogen near the root zone and PSB increases the availability of phosphorus to the plants resulted in enhancement of the level of macronutrients and other growth promoting substances like vitamin, enzymes and antibiotics to the plant which have positive impact on floral characteristics that may be enhance the plant height and ultimately increase the rachis length. The results were in confirmation with the findings of Adhikari *et al* (2018) in gladiolus and Kabir *et al* (2011) and Basant *et al* (2020) in tuberose.

Number of florets per spike

Highest number of florets per spike (14.20) was noticed in treatment T_5, which give better performance than treatment T_1, T_2, T_7, T_8, T_9 and T_{10}, whereas the result obtained in T_5 were found statistically *at par* with the treatments T_6, T_3 and T_4. However, minimum number of florets per spike observed in treatment T_1 (12.27). Application of bio-fertilizers that may be favourable for the rapid multiplication of bacteria in the rhizosphere which created favourable condition for nitrogen fixation and solubilization of phosphorus along with supply of nitrogen and other essential nutrients for longer period through inorganic fertilizer and foliar spray that may be responsible for increasing the internodal length and ultimately the number of florets per spike. This result was in close conformity with the findings of Rajhansa *et al* (2010) and Sathyanarayana *et al* (2017) in gladiolus. The result was alike to the observations of Kumar and Saravanan (2019) and Pandey *et al* (2020) in gladiolus and Hadwani *et al* (2013) in tuberose.

CONCLUSION

Different types of treatment combinations significantly influenced vegetative growth and flowering in gladiolus. From the above experiment, it was observed that the treatment T_5 [75% RDF + FYM@12.5t/ha + Azotobacter@ 4 kg/ha + PSB@ 4kg/ha + 0.3% foliar spray of WSF 13:0:45 (Once)] performed better in giving earliest 50% sprouting of corms, more number of shoots per plant, maximum plant height, more number of leaves, earliest in spike emergence, first floret open, more number of spike per plant, Maximum spike and rachis length and more number of florets per spike.

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